

***PHYSARIA IVEYANA* (BRASSICACEAE), A NEW SPECIES FROM THE
SANDIA MOUNTAINS, NEW MEXICO**

STEVE L. O'KANE, JR.*, KELLY N. SMITH, and KATIE A. ARP

Department of Biology
University of Northern Iowa
Cedar Falls, Iowa 50614-0421

*author for correspondence: steve.okane@uni.edu

ABSTRACT

Physaria iveyana (Brassicaceae), a new species from the summit of the Sandia Crest, Sandia Mountains, New Mexico, is described and illustrated. This entity has long been known as distinctive and has been recognized as deviating from typical *P. pinetorum* in that it has subumbellate infructescences that do not elongate and that do not or only barely exceed the basal leaves, forms dense rock-hugging tufts, and occurs at a higher elevation and in a more extreme wind-swept habitat.

KEY WORDS: *Physaria iveyana*, *Physaria pinetorum*, Brassicaceae, Sandia Mountains

In their treatment of the genus *Lesquerella* S. Watson — now mainly included in *Physaria* (Nuttall) A. Gray — Rollins and Shaw (1993) noted that at high elevations in the Sandia Mountains of New Mexico some populations of *Physaria pinetorum* (Wooton & Standley) O'Kane & Al-Shehbaz are strongly reduced. They stated (p. 132) that these plants “. . . are small and matted and tend to have spatulate to oblanceolate basal leaves, often less than 2 cm. long, with a short slender petiole. The stems are greatly reduced, frequently not extending beyond the leaves, and the infructescences are subcorymbose.” Rollins and Shaw concluded that this unusual form was simply a morphological response to edaphic conditions and high elevation. To the best of our knowledge, no similar plants are found in harsh, high-elevation habitats elsewhere. Where *P. pinetorum* is elsewhere found growing in these conditions, the plants are smaller but are otherwise typical for the species. Julyan and Stuever (2005) indicated that other species of *Physaria* in the Sandia Mountains typically grow in the dry foothills but that *P. pinetorum*, while growing there, also grows on the crest of the mountains.

In his early monograph of *Lesquerella*, Payson (1921) implied that there was considerable variation among the few specimens of *Physaria pinetorum* at his disposal and wondered if two or more varieties should be recognized (p. 194). One of the specimens he examined, *Herrick 204* (US), came from the crest of the Sandias. An annotation on this specimen indicates that Wooton and Standley considered naming this form “*Lesquerella parva*,” although they did not publish the name (Rollins & Shaw 1973). O'Kane (2010) previously opined that the dwarfed, high-elevation specimens from the crest of the Sandias should be recognized as a separate taxon. We here describe this new taxon at specific rank.

PHYSARIA IVEYANA O'Kane, K.N. Smith, and K.A. Arp, sp. nov. **TYPE:** USA. New Mexico. Bernalillo Co.: Sandia Mountains, The Sandia Crest. 35° 12.609' N, 106° 26.981' W, 10,700 ft (3723 m) elev. 9 Jul 2009, *S.L. O'Kane, Jr. 9197* (holotype, MO; isotypes, ARIZ, BRY, COLO, GH, ISTC, K, NMC, NY, UNM).

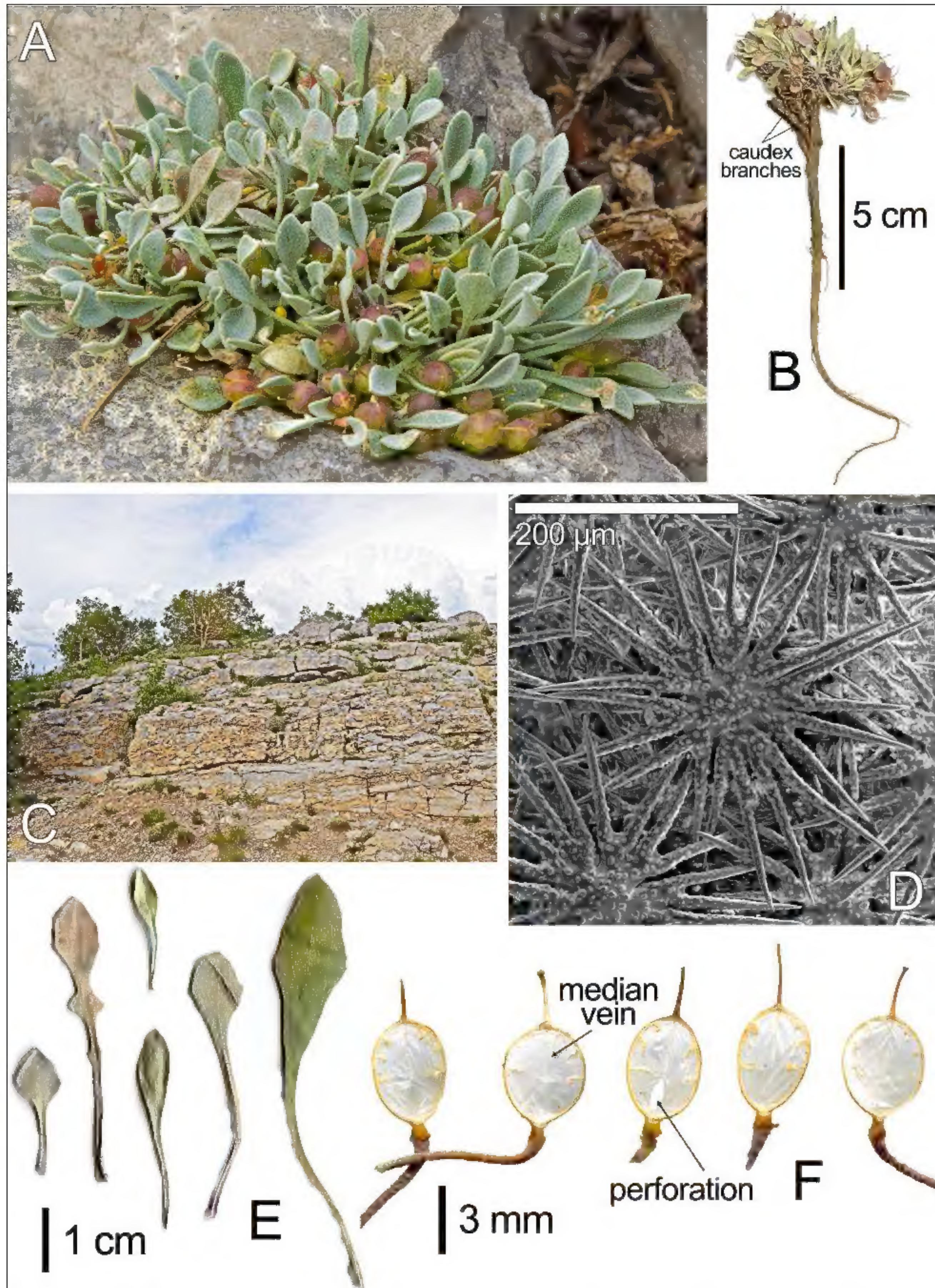


Figure 1. A. Habit. B. Above and below-ground phenotype. C. Limestone habitat. D. SEM micrograph of trichome detail. E. Basal leaf variation. F. Replum and septum variation.

Physaria iveyana differs from *P. pinetorum* in that it has subumbellate infructescences (rather than obviously racemose) that do not elongate (rather than elongate) and that do not or only barely exceed (rather than exceed) the basal leaves, forms dense rock-hugging tufts (rather than forming looser tufts), and occurs at a higher elevation and in a more extreme wind-swept habitat (rather than occurring generally below 2900 m elevation in more protected spots).

Herbs, long-lived perennials from a taproot, forming small densely caespitose ground-hugging tufts from a simple or usually sparsely and closely branched underground caudex, caudex branches 2–8 mm long $\times$ 0.5–4.3 mm wide, elongating slightly with age, old leaf bases mostly deciduous. **Stems** 2–10(–18) per plant, (0.2–)0.5–5.5(–6.5) cm long, unbranched, ascending to erect, arising from within the 3.5–12.0 cm wide tuft of erect or ascending basal leaves. **Herbage** pale-green to gray-green, densely covered with overlapping stellate trichomes, the herbage silvery gray-green, sometimes tinged purple, the silver color due to a dense, covering of overlapping stellate trichomes, these 250–375 μ m in diameter from tip to tip, with 7–9 main rays, each bifurcating, and sometimes bifurcating again, sometimes incompletely, ray tips (14–)17–23 per trichome, main rays webbed at the very base (visible at high magnification), trichome center slightly-mounded and tuberculate. **Leaves**: basal mainly entire, larger leaves often undulate, or lyrate, or with 2–few weak teeth, blades mainly spatulate, some rhombic or elliptic, flat, tapering to a slightly winged petiole, apex curved-obtuse to slightly rounded-acute, including the petiole 12–50(–64) mm $\times$ 1–8(–11) mm, encrusted with trichomes; cauline entire, narrowly spatulate to nearly elliptic, flat, attenuate at base and tapering to a slightly winged petiole, (0–)2–6 per stem, including the petiole 5–26(–31) mm $\times$ 1–5 mm. **Infructescence** not elongating, not exceeding or barely exceeding the basal leaves, a condensed nearly umbellate raceme with 3–16, $\pm$ crowded fruits, on ultimately sigmoid (some ascending) pedicels 4.5–15(–20) mm long. **Flowers** with sepals 4.3–5 mm long, elliptic to narrowly triangular, rounded on back, lateral sepals often keeled at the base; petals entire, yellow, 5.5–8.1 mm long, blade 2.2–3.6 mm wide, claw 0.7–1.3 mm wide, spatulate or the blade somewhat wider. **Stamens** 6, the median ones with filaments 3.4–4.1 mm long, lateral ones 2.3–3.8 mm long; anthers 0.9–1.1 mm long, oblong to narrowly triangular in outline, basal lobes usually flaring, these 0.2–0.5 mm long. **Silicles** on stipes 0.2–0.7 mm, ovoid to nearly spherical, apex rounded; base rounded-obtuse; mostly longer than wide, 3.4–6.2 $\times$ 2.0–4.6 mm; valves glabrous within and on the exterior, becoming purple-coppery at maturity. **Ovules** (10–)12–16(–20) per ovary, these attached to the upper 1/2–2/3 of the replum; false septum mostly entire to less frequently perforate basally in the center; replum obovate to subovate, rounded at the apex. **Styles** fine, glabrous, linear to curved apically, (1–)2.5–4.0 mm, including the capitate stigma, which is slightly wider than the style. **Seeds**, flattened, lenticular, brown to dark brown, oval to suborbicular, wider than long, 1.4–2.0 $\times$ 1.3–1.9 mm, wingless, slightly mucilaginous when wetted; cotyledons accumbent. Figure 1.

Paratype. USA. New Mexico. Bernalillo Co.: Sandia Crest, Sandia Mountains. 35° 12.641' N, 106° 26.983' W, 10,690 ft (3258 m) elev, 23 July 2008, S.L. O'Kane, Jr. & K.D. Heil 9056 (ISTC, SJNM).

Etymology. The species is named for Robert DeWitt Ivey, outstanding New Mexico naturalist. Raised in Jacksonville, Florida, he graduated from the University of Florida in 1945 as class valedictorian with a double major in English and biology. He continued his studies there specializing in mammalogy under Dr. Harley Sherman. In 1947 he became an instructor at the University of New Mexico. In 1949 he did more graduate work at the University of Michigan and then spent a year teaching at the College of Charleston in South Carolina. In 1951 he felt the need to return to the wide-open skies of New Mexico and started teaching biology for the Albuquerque Public Schools. He and his students continued his work on mammals until the threat of bubonic plague and Hantavirus became a problem. He then turned his attention to botany and in 1983 published the first edition of his manual of botanical illustrations, *Flowering Plants of New Mexico*, which had hundreds

of drawing of species which cleverly focused in on the most important characters for identification. In 2008 the greatly expanded fifth edition was published, illustrating more than one third of the species known for the state. *Flowering Plants of New Mexico* is likely the most consulted plant identification reference in the state and is used as a text in the Flora of New Mexico course at the University of New Mexico. Ivey has given numerous talks, workshops, and field trips throughout the state. His work has done much, perhaps more than any other, to stimulate interest in the plants of New Mexico and their appreciation and preservation.



Figure 2. Locality of type collection and additional local area searched. Image from Google Earth

Ecology. *Physaria iveyana* (Ivey's bladderpod) inhabits the wind-swept, relatively high-elevation, barren grey Madera Formation limestone escarpment on the west-facing summit of Sandia Peak (Read et al. 2000) (Fig. 2). It grows from fractures in the exposed limestone or in nearly barren limestone rubble with nearby individuals of the trees *Pinus strobiformis*, *Pseudotsuga menziesii*, and stunted individuals of *Populus tremuloides*. Scattered herbaceous plants include species of *Allium*,

Pedicularis, *Poa*, *Erigeron*, *Achillea*, *Cerastium*, *Cymopterus*, *Hymenoxys*, *Penstemon*, and *Oxytropis*.

Physaria iveyana is another example of a new, high elevation, narrowly endemic species in a genus that otherwise is mainly limited to lower montane areas, grasslands, pygmy forests, and deserts. High elevation species are few, e.g., *P. alpina* Rollins, *P. humilis* (Rollins) O'Kane & Al-Shehbaz, *P. eriocarpa* Grady & O'Kane, *P. scrotiformis* O'Kane all grow from barren or nearly barren outcrops of limestone or dolomite, and most of these were only recently named (Grady & O'Kane 2007; O'Kane 2007; Rollins 1981). The endemic and rare *Heuchera pulchella* Wooton & Standley occupies immediately adjacent habitat of the same limestone on the Sandia Crest but back from the very edge of the escarpment, where it grows from rock cracks (New Mexico Rare Plant Technical Council 2012).

Similar habitat was searched in the Manzano Mountains, but *Physaria iveyana* was not found there. Smaller but otherwise typical individuals of *P. pinetorum* (Wooton & Standl.) O'Kane & Al-Shehbaz were found.

IUCN Red List category. *Physaria iveyana* is currently known only from one narrow, approximately 4.5–15 meters wide metapopulation of the Sandia Crest west-facing escarpment. This metapopulation is immediately adjacent to a parking lot, a radio tower facility, and a hiking trail. It is probable that portions of this population have already been lost to activities related to the construction and development of these facilities. Based on the limited aerial extent of the known (and perhaps only) metapopulation of this species, it could be listed according to IUCN Red List criteria (2001) as EN (Endangered) under Criteria B2a and C2a(i).

Taxonomy. *Physaria iveyana* is clearly related to *P. pinetorum*, both morphologically and based on preliminary molecular analyses (O'Kane unpublished). In the recent key to *Physaria* of North America (O'Kane 2010, p. 620), *P. iveyana* and *P. pinetorum* can be distinguished by replacing couplet 49 with the following.

49. Stems prostrate; cauline leaves densely overlapping..... 36. *Physaria gordonii* (in part)
 49. Stems ascending to erect; cauline leaves (relatively few), not or loosely overlapping.
- 49a. Inflorescences subumbellate, barely (or not at all) exceeding the basal leaves; plants forming dense mat-like tufts 68. *Physaria pinetorum*
 49b. Inflorescences racemose, elongate and evidently exceeding the basal leaves; plants caespitose, but not forming dense tufts *Physaria iveyana*

ACKNOWLEDGEMENTS

O'Kane thanks Ken Heil for his unflagging support and friendship, for his long-term botanical field work in New Mexico, and for being along when he first encountered this unnamed species in the field. We thank Gene Jercinovic who supplied the biographical details for Robert DeWitt Ivey.

LITERATURE CITED

- Grady, B.A. and O'Kane, S.L., Jr. 2007. New species and combinations in *Physaria* (Brassicaceae) from western North America. *Novon* 17: 182–192.
- IUCN. 2001. IUCN Red List Categories and Criteria Version 3.1. IUCN Species Survival Commission. IUCN, Gland, Switzerland, and Cambridge, United Kingdom.
- Julyan, R. and M. Stuever (eds.). 2005. Field Guide to the Sandia Mountains. Univ. New Mexico Press, Albuquerque.

- New Mexico Rare Plant Technical Council. 2012. New Mexico Rare Plants website. <<http://nmrareplants.unm.edu/index.html>> Accessed 28 May 2011
- O'Kane, S.L., Jr. 2010. *Physaria*. Pp. 616–665, in Flora of North America Editorial Committee, Flora of North America, Vol. 7. Oxford Univ. Press, New York and London.
- O'Kane, S.L., Jr. 2007. *Physaria scrotiformis* (Brassicaceae), a new high-elevation species from southwestern Colorado and new combinations in *Physaria*. *Novon* 17: 376–382.
- Payson, E. B. 1921 [1922]. A monograph of the genus *Lesquerella*. *Ann. Missouri Bot. Gard.* 8: 103–236.
- Read, A.S., K.E. Karlstrom, S. Connell, E. Kirby, C.A. Ferguson, B. Ilg, G.R. Osburn, D. Van Hart, and F.J. Pazzaglia. 2000. Geology of Sandia Crest Quadrangle, Bernalillo and Sandoval Counties, New Mexico. New Mexico Bureau of Mines and Mineral Resources.
- Rollins, R.C. 1981. Studies in the genus *Physaria* (Cruciferae). *Brittonia* 33: 332–341.
- Rollins, R.C. and E.A. Shaw. 1973. The Genus *Lesquerella* (Cruciferae) in North America. Harvard Univ. Press., Cambridge, Mass.